

## AMENDMENTS TO THE CLAIMS

**1. (Currently Amended)** A computer-implemented computing device comprising: a processor; and a compiler apparatus having instructions stored thereon for causing a computer to translate for translating a source program into a machine language program, said compiler apparatus comprising:

- a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

- an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

- wherein the optimization unit performs the optimization by deciding array data allocated to a global memory region following a directive when the directive acquisition unit acquires the directive on the array data to be allocated to the global memory region,

- wherein the global memory region is specified by a head address and a displacement,

- wherein the head address is indicated by a value stored in a register,

- wherein the displacement is within a range of the global memory region that can be accessed by one instruction, and

- wherein the range is determined based on a type and a size of an object.

**2. (Currently Amended)** The compiler apparatus computing device according to Claim 1,

- wherein the directive acquisition unit acquires designation of a maximum data size of array data to be allocated to the global memory region together with a directive for translating the source program, and

- the optimization unit allocates array data whose maximum data size does not exceed the maximum data size to the global memory region and array data whose maximum data size exceeds the maximum data size to a memory region out of the global memory region, based on array data declared by the source program.

**3. (Currently Amended)** The compiler apparatus ~~computing device~~ according to Claim 1,

wherein the directive acquisition unit detects a directive for not allocating specific array data to the global memory region in the source program, and

the optimization unit allocates array data that is an object of a directive detected by the directive acquisition unit to a memory region out of the global memory region.

**4. (Currently Amended)** The ~~computing device~~compiler apparatus according to Claim 1,

wherein the directive acquisition unit detects a directive for allocating specific array data to the global memory region in the source program, and

the optimization unit allocates array data that is an object of a directive detected by the directive acquisition unit to the global memory region.

**5. (Previously Presented)** A computer-readable recording medium on which a source program described in a high-level language is recorded,

wherein the source program includes at least one of descriptions for directing a compiler that translates the source program into a machine language program (1) not to allocate a specific array data to a global memory region and (2) to allocate the specific array data to the global memory region,

wherein the global memory region is specified by a head address and a displacement,

wherein the head address is indicated by a value stored in a register,

wherein the displacement is within a range of the global memory region that can be accessed by one instruction, and

wherein the range is determined based on a type and a size of an object.

**6-7. (Canceled)**

**8. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising: A computing device comprising:

~~a processor; and~~

~~a compiler apparatus for translating a source program into a machine language program, said compiler apparatus comprising:~~

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs optimization on software pipelining following a directive when the directive acquisition unit acquires the directive on optimization by software pipelining,

wherein the directive acquisition unit detects a directive for not performing the optimization by software pipelining of a specific loop processing in the source program, and

wherein the optimization unit restrains the optimization by software pipelining of loop processing that is an object of the directive detected by the directive acquisition unit.

**9. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising: A computing device comprising:

~~a processor; and~~

~~a compiler apparatus for translating a source program into a machine language program, said compiler apparatus comprising:~~

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs optimization on software pipelining following a directive when the directive acquisition unit acquires the directive on optimization by software pipelining,

wherein the directive acquisition unit detects a directive for performing the optimization by software pipelining that removes a prolog portion and an epilog portion of a specific loop processing in the source program, and

wherein the optimization unit performs the optimization by software pipelining of loop processing that is an object of the directive detected by the directive acquisition unit whenever possible to remove the prolog portion and the epilog portion.

**10. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising: A computing device comprising:

a processor; and

a compiler apparatus for translating a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs optimization on software pipelining following a directive when the directive acquisition unit acquires the directive on optimization by software pipelining,

wherein the directive acquisition unit detects a directive for performing the optimization by software pipelining that does not remove the prolog portion and the epilog portion of a specific loop processing in the source program, and

wherein the optimization unit performs the optimization by software pipelining of loop processing that is an object of the directive detected by the directive acquisition unit whenever possible not to remove the prolog portion and the epilog portion.

**11. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising: ~~A computing device comprising:~~

~~a processor; and~~

~~a compiler apparatus for translating a source program into a machine language program, said compiler apparatus comprising:~~

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs optimization on software pipelining following a directive when the directive acquisition unit acquires the directive on optimization by software pipelining,

wherein the directive acquisition unit detects a designation of the number of iterations of specific loop processing in the source program, and

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations.

**12. (Currently Amended)** The compiler apparatus ~~computing device~~ according to claim 11,

wherein the designation of the number of the iterations is the minimum number by which the loop processing is iterated, and the optimization unit performs the optimization by software pipelining when the minimum number is equivalent to or larger than the number of iterations that

overlap by software pipelining.

**13. (Original)** A computer-readable recording medium on which a source program described in a high-level language is recorded,

wherein the source program includes at least one of descriptions for directing a compiler that translates the source program into a machine language program (1) not to perform the optimization by software pipelining of a specific loop processing, (2) to perform optimization that removes a prolog portion and an epilog portion by software pipelining of the specific loop processing, and (3) to perform optimization that does not remove the prolog portion and the epilog portion by software pipelining of the specific loop processing.

**14-18. (Canceled)**

**19. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following an acquired directive,

wherein the optimization unit performs optimization by loop unrolling following a directive when the directive acquisition unit acquires the directive on the optimization by loop unrolling,

wherein the directive acquisition unit detects designation of the number of iterations of specific loop processing in the source program,

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations,

~~The computing device according to claim 18,~~  
wherein the designation of the number of the iterations is the minimum number by which the loop processing is iterated, and  
wherein the optimization unit restrains generation of an escape code that is needed in the case of the number of the iterations being 0 when the minimum number is 1 or more.

**20. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following an acquired directive,

wherein the optimization unit performs optimization by loop unrolling following a directive when the directive acquisition unit acquires the directive on the optimization by loop unrolling,

wherein the directive acquisition unit detects designation of the number of iterations of specific loop processing in the source program,

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations,

~~The computing device according to claim 18,~~  
wherein the designation of the number of the iterations is the minimum number by which the loop processing is iterated, and  
wherein the optimization unit performs the optimization by loop unrolling when the minimum number is equivalent to or more than the number of development by the loop unrolling.

**21. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following an acquired directive,

wherein the optimization unit performs optimization by loop unrolling following a directive when the directive acquisition unit acquires the directive on the optimization by loop unrolling,

wherein the directive acquisition unit detects designation of the number of iterations of specific loop processing in the source program,

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations,

~~The computing device according to claim 18,~~

wherein the designation of the number of the iterations guarantees that the loop processing is iterated only an even number of times, and

wherein the optimization unit performs the optimization by loop unrolling assuming that the loop processing that is an object of designation detected by the directive acquisition unit is iterated only the even number of times.

**22. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of



machine language instructions following an acquired directive,

wherein the optimization unit performs optimization by loop unrolling following a directive when the directive acquisition unit acquires the directive on the optimization by loop unrolling,

wherein the directive acquisition unit detects designation of the number of iterations of specific loop processing in the source program,

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations,

~~The computing device according to claim 18,~~

wherein the designation of the number of the iterations guarantees that the loop processing is iterated only an odd number of times, and

wherein the optimization unit performs the optimization by loop unrolling assuming that the loop processing that is an object of designation detected by the directive acquisition unit is iterated only the odd number of times.

### **23-29. (Canceled)**

**30. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising: A computing device comprising:

~~a processor; and~~

~~a compiler apparatus for translating a source program into a machine language program, said compiler apparatus comprising:~~

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs optimization by allocating data in a memory region following a directive when the optimization unit acquires the directive on alignment of the array data to be allocated in a memory region,

wherein the directive acquisition unit acquires a directive for alignment of array data of a specific type together with a directive for translating the source program, and

wherein the optimization unit allocates all the array data of the specific type declared in the source program in the memory region so that its head address matches the alignment.

**31. (Canceled)**

**32. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising: ~~A computing device comprising:~~

~~a processor; and~~

~~a compiler apparatus for translating a source program into a machine language program, said compiler apparatus comprising:~~

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs optimization by allocating data in a memory region following a directive when the optimization unit acquires the directive on alignment of the array data to be allocated in a memory region, and

wherein the directive acquisition unit detects a designation of alignment of data that a pointer variable of argument shown by the name of a specific variable indicates in the source program, and

wherein the optimization unit performs the optimization assuming that the data that is an object of designation detected by the directive acquisition unit is allocated in the memory region

by the designated alignment.

**33. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising: ~~A computing device comprising:~~

~~a processor; and~~

~~a compiler apparatus for translating a source program into a machine language program, said compiler apparatus comprising:~~

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs optimization by allocating data in a memory region following a directive when the optimization unit acquires the directive on alignment of the array data to be allocated in a memory region, and

wherein the directive acquisition unit detects a designation of alignment of data that a local pointer variable shown by the name of a specific variable indicates in the source program, and

wherein the optimization unit performs the optimization assuming that the data that is an object of designation detected by the directive acquisition unit is allocated in the memory region by the designated alignment.

**34. (Canceled)**

**35. (Previously Presented)** A computer-readable recording medium on which a source program described in a high-level language is recorded, wherein the source program includes at least one of descriptions for directing a compiler that translates the source program into a machine language program (1) to require a guarantee on alignment of data that a pointer variable

of argument shown by the name of a specific variable indicates and (2) to require a guarantee on alignment of data that a local pointer variable shown by the name of a specific variable indicates.

**36. (Previously Presented)** A computer readable medium having a program stored thereon, the program being for a compiler apparatus that translates a source program into a machine language program, the program causing a computer to function as:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs the optimization by deciding array data allocated to a global memory region following a directive when the directive acquisition unit acquires the directive on the array data to be allocated to the global memory region,

wherein the global memory region is specified by a head address and a displacement,

wherein the head address is indicated by a valued stored in a register,

wherein the displacement is within a range of the global memory region that can be accessed by one instruction, and

wherein the range is determined based on a type and a size of an object.

**37-39. (Canceled)**

**40. (Previously Presented)** A computer readable medium having a program stored thereon, the program being for a compiler apparatus that translates a source program into a machine language program, the program causing a computer to function as:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following the acquired directive,

wherein the optimization unit performs optimization by allocating data in a memory region following a directive when the optimization unit acquires the directive on alignment of the array data to be allocated in a memory region.

**41. (Canceled)**

**42. (Currently Amended)** The compiler apparatus ~~computing device~~ according to claim 32,

wherein the optimization unit generates a pair instruction for transferring two or more kinds of data at the same time regarding a memory access instruction for accessing the data to be allocated in the memory region.

**43. (Currently Amended)** The compiler apparatus ~~computing device~~ according to claim 33,

wherein the optimization unit generates a pair instruction for transferring two or more kinds of data at the same time regarding a memory access instruction for accessing the data to be allocated in the memory region.

**44-47. (Canceled)**

**48. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following an acquired directive,

wherein the directive acquisition unit detects designation of the number of iterations of

specific loop processing in the source program,

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations,

~~The computing device according to claim 46,~~

wherein the designation of the number of the iterations is the minimum number by which the loop processing is iterated, and

wherein the optimization unit restrains generation of an escape code that is needed in the case of the number of the iterations being 0 when the minimum number is 1 or more.

**49. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following an acquired directive,

wherein the directive acquisition unit detects designation of the number of iterations of specific loop processing in the source program,

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations,

~~The computing device according to claim 46,~~

wherein the designation of the number of the iterations is the minimum number by which the loop processing is iterated, and

wherein the optimization unit performs the optimization by loop unrolling when the minimum number is equivalent to or more than the number of development by the loop unrolling.

**50. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following an acquired directive,

wherein the directive acquisition unit detects designation of the number of iterations of specific loop processing in the source program,

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations,

~~The computing device according to claim 46,~~

wherein the designation of the number of the iterations guarantees that the loop processing is iterated only an even number of times, and

wherein the optimization unit performs the optimization by loop unrolling assuming that the loop processing that is an object of designation detected by the directive acquisition unit is iterated only the even number of times.

**51. (Currently Amended)** A computer-implemented compiler apparatus having instructions stored thereon for causing a computer to translate a source program into a machine language program, said compiler apparatus comprising:

a directive acquisition unit operable to acquire a directive for optimizing a machine language program to be generated; and

an optimization unit operable to perform optimization by generating a sequence of machine language instructions following an acquired directive,

wherein the directive acquisition unit detects designation of the number of iterations of specific loop processing in the source program,

wherein the optimization unit performs optimization of loop processing that is an object of the designation detected by the directive acquisition unit based on the designated number of iterations.

~~The computing device according to claim 46,~~  
wherein the designation of the number of the iterations guarantees that the loop processing is iterated only an odd number of times, and

wherein the optimization unit performs the optimization by loop unrolling assuming that the loop processing that is an object of designation detected by the directive acquisition unit is iterated only the odd number of times.

**52. (Currently Amended)** The compiler apparatus ~~computing device~~ according to claim 8, wherein the loop processing that is an object directive detected by the directive acquisition unit is a loop processing that appears first after the directive for not performing the optimization by software pipelining in the source program.

**53. (Currently Amended)** The compiler apparatus ~~computing device~~ according to claim 9, wherein the loop processing that is an object directive detected by the directive acquisition unit is a loop processing that appears first after the directive for performing the optimization by software pipelining in the source program.

**54. (Currently Amended)** The compiler apparatus ~~computing device~~ according to claim 10, wherein the loop processing that is an object directive detected by the directive acquisition unit is a loop processing that appears first after the directive for performing the optimization by software pipelining in the source program.